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LXXXIV. *Observations made upon the Brimstone-Hill (in French La Souffriere) in the Island of Guadelupa; by John Andrew Peyssonel, M. D. Member of the Royal Academies of Sciences of Paris and Montpelier, and of Marseilles and Rouen; the King of France's Physician and Botanist heretofore on the Coast of Barbary, and now in the Island of Guadelupa, F. R. S. Translated from the French by M. Maty, M. D. and F. R. S.*

Read Mar. 25, 1756. **T**HE Island of Guadelupa is not the only one of the American Antilles, that has Volcanoes and mines of brimstone; few are without them. They are to be found in Martinico, Dominica, St. Christopher's, St. Lucia; and all these islands produce sulphur, pumice-stones, and other substances usually found in Volcanoes.

The mountain, upon which I made my observations, is called La Souffriere, or Brimstone-hill, because it contains ores of sulphur; and its summit constantly emits smoke, and sometimes flames. It is very high, and forms a kind of truncated cone. It rises above the chain of mountains, that occupy the center of the island, and run through all its length from North to South. This conical mountain is about three leagues from the sea shore, East, West, and South, and therefore almost in the middle of the Southern part of the island.

The

The journey up this mountain is not now so difficult as it was in the time of father Labat, in the year 1695. Much more commodious roads are now used than that which he followed. Travellers generally lie at some house at the foot of the mountain. From thence they go on horseback as far as the torrent, where they have the choice of two different ways. The first begins at a place called Les Gommiers, or The Gum-trees, along the river of Galleons; the other lies towards the middle of the mountain, at a place called Tarare, where they cross the river St. Lewis.

You generally set out early from the place where you have spent the night, and breakfast in the cool of the morning, on the banks of one of the rivers, whose waters are very clear and good, and produce great quantities of small fish, such as cray-fish, bull-heads, eels, &c. This is one of those delights so emphatically described by father du Tertre. We perceived these waters to be diuretic, by the sudden effect they had upon us.

We took the road of the Gum-Trees as being the easiest. I soon observed, that the woods differed in kind, as we ascended; the trees are smaller, and are no more than shrubs at the top, that is to say, on a level with the other mountains. Here you meet with none but mountain-mangles, whose wood is crooked and bends downwards. The bark of these mangles is a true jesuit's bark*. When we had passed through this forest of mangles, which are as

* F. Labat made the same observation. See *Voyage aux Isles de l'Amérique*. Tom. II.

a curtain, we got into the savannah. A savannah in this country is a kind of natural meadow. This particular one is made up of fern, moss, a sort of ananas, and wild aloes, and such-like plants, without either tree or shrub. I believe we met with almost all the hundred different sorts of fern, which make up father Plumiere's voluminous work.

We walked on for about 600 paces, in a path that goes through this savannah. The way is rugged. The ananas, that are very bushy and above two feet high, conceal the roots and rocks, which makes walking very troublesome. About nine in the morning, after an hour's march from the place, where we had breakfasted, we arrived at the spring-head of the river of galleons, South of the Brimstone-hill. At the place called The Three Springs, we found the waters so hot as not to be borne. The neighbouring ground smokes, and is full of brown earth like the dross of iron. In other places the earth is red like colcothar, and even dyes one's fingers; but these earths are tasteless. Near these three burning hot springs are some others, that are lukewarm, and some very cold. We put some eggs into the hot ones, and they were boiled in three minutes, and hard in seven.

I had brought a hydrometer, or instrument to weigh liquors, which plunged six lines in the common water of the rivers to leeward, and two lines in sea water. It sunk twelve lines in the hot, and eight in the lukewarm springs.

When we had made our observations on the different sorts of earth and water, we entered a valley between The Brimstone-hill and the mountain, that lies

lies Southward, called The Mountain of the Three Rivers. Here we met some negroes carrying brimstone to sell it in the low-lands. We walked in the same savannah, and among the same weeds, which grew so thick, that we could not discover the nature of the soil.

We went on, about the length of 400 paces, when we began to get sight of the windward, or of the Eastern coast of the island. Having likewise discovered the burning gulph to the Northward of us, we crawled up to get at it. We were obliged to help ourselves with our hands, feet, elbows, and knees, and to hold by the fern, aloes, and other plants, some of which were prickly, and very troublesome. We were about an hour and a half getting up to the hight of about 500 feet; tis true we might have taken a smoother way by going round about. At last, quite out of breath, we reached the gulph, at the place whence the smoke issues. This place is at the foot of a steep bank, and may be about 25 toises in breadth: there is no grass to be seen, nothing but sulphur and calcined earth; the ground is full of crevices, which emit smoke or vapours; these cracks are deep, and you hear the sulphur boil. Its vapours rising yield very fine chemical flowers, or a pure and refined sulphur. It is chiefly found in those places where the earth lies hollow, and upon the chinks or funnels you see the spirit of sulphur run down like fair water, and you breathe an intolerable smell of brimstone. The ground is loose, insomuch that we could thrust our canes up to the head, and drew them out as hot, as if we had plunged them into lime when it is flaking. Having inadvertently run

ourselves into this loose ground among these chinks, and being smothered with the smoke or vapours, we were continually afraid of sinking, and meeting with some hole or pit, and so tumbling into hell from the top of this mountain, which we imagined to be one of the vents of the infernal regions, or a mouth of the burning gulph; and we expected to perish like Pliny the naturalist, who was smothered by the flames of Vesuvius, which is said to have happened in the 79th year of the Christian æra, at the time of that great earthquake, which, having overturned whole cities, drove the ashes as far as Africa, Syria and Egypt. I confess, the distance, that these ashes are said to have travelled thro' the air, appears to me to be very great, for Italy is near a thousand leagues from Syria.

We hastened out of this dangerous situation, and continued climbing to the top of the mountain, keeping to the East, or windward. When we got to the summit, we discovered another gulph or funnel, that opened some years since, and emits nothing but smoke. The top of the mountain is, as father Du Tertre says, a very uneven plain, covered with heaps of burnt and calcined earth of various sizes; the ground smokes only at the new funnel, but appears to have formerly burnt in many places; for we observed abundance of these crevices, and even gutters, and very large and deep chinks, which must have burnt in former times.

The same reasons, that obliged us to quit the burning gulph, probably hindered father Labat from viewing this summit, and prevented his coming at the knowledge of a very deep abyf, or precipice, which is in the middle of this flat.

It is said, there was once a great earthquake in this island, and that The Brimstone-hill took fire, and vomited ashes on all sides. This mountain then cleft in two; but it is not said what year this phænomenon happened. I am apt to think it was then, that this abyſs or precipice opened. Perhaps the Volcano having been fired by lightning, the salts of the earth joined with the sulphur produced the effect of gunpowder, and occasioned this dreadful earthquake. The mountain having split, cast forth ashes and fulphureous matters all around, and from that time no earthquake has been felt in the island.

These phænomena are but too common in Italy, particularly in the kingdom of Naples; and in other countries where there are Volcano's, we are told of most terrible disasters of this kind. In 1556 a Volcano in the island of Java poured forth a torrent of melted and burning sulphur with such impetuosity, that ten thousand persons perished in three days. The same year mount Guamanapi, in one of the Bandava islands, made terrible havock; the waters of the sea were heated to such a degree near the island, that the fish were found ready boiled upon the strand, but we don't hear, that any of those mountains ever split in two like this.

We cannot doubt of the dreadful effects, which have been, and still are produced by earthquakes: witness the last that happened at Jamaica, and now that of Lisbon.

The abyſs I am speaking of, is in the middle of the flat, behind two crags or points, that rise above the mountain, and on the North side answers to the great cleft, which goes down above a thousand feet

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perpendicular, and penetrates above a hundred paces into the flat, and is more than twenty feet broad; so that in this place the mountain is fairly split, from the top down to the basis of the cone.

On the North side, opposite to the cleft, and at the foot of the mountain, in a little plain, is a pool, which is said to ebb and flow like the sea, and to increase and decrease at certain times, according to the periods of the moon: but people are fond of ascribing wonderful properties to things, which, if simply related, would not appear so extraordinary. For my part, I am apt to think this pool is formed by the waters that drain along the great cleft into this little plain, where the same earthquake has sunk a hollow place near the great subterranean cavern, of which by and by; and that the variations of the water in this pool are occasioned by the rains.

It was about noon when we got upon the flat, on the summit of the mountain. It looks as if it had formerly been of a conical figure, and had lost its top by earthquakes. What confirms me in this conjecture is, the pieces of rock, which still subsist, and form those spires, or little cones, that are scattered here and there upon the summit; the two most considerable of which are towards the West, and make as it were, a pair of horns to the mountain.

Here we dined, and rested above an hour. There is a most delightful prospect. You discover below the islands of Martinico, Dominica, The Saints, Marigalante, and the whole extent of Guadelupa. Tis said, those of St. Vincent, St. Kits, and even St. Martin, have been seen from the top of this mountain. Be that as it will, we observed very distinctly

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Montserrat, Antigua, Nevis, Radonde, and several other islands.

The air at top is bleak and sharp, but I can't say I found the cold very intense. It is true many negroes have perished there with cold ; but that is not to be wondered at, as these people are not inured to the severity of the weather, and go naked ; they wear no clothes but a pair of drawers, and have nothing to eat. Sometimes they are catched in the rain, or exposed to damps and fogs ; or else when they are all in a sweat with fatigue and labour, and lie down to rest, the cold seizes them and chills their blood ; and it is no wonder, if they perish in this condition.

Besides the fine prospect you enjoy at the top of this mountain, you have the pleasure, as father Du Tertre observes, of seeing the clouds gather below, and hearing the thunder rumble under your feet. We actually saw the clouds rise from the sea, and spread over the land on the side of the wind, sometimes passing where we stood, and sometimes lower. These clouds are no other than damp fogs. The Brimstone-hill is seldom clear of these damps.

As my thermometers and barometers were broke in going up, I could make no observations on the gravity and properties of the air. It was but in my subsequent journies to this mountain, that I could in some measure gratify my curiosity in these particnlars. We had only time to examine the great cavern and the great cleft above it, and then withdrew to the habitation whence we came, being very weary ; for in coming down we were often obliged to slide, sometimes sitting, sometimes lying on our backs, and holding by the fern. We frequently tumbled into holes, where

where we were almost buried, but were in no great danger, because the fern and moss make a kind of down, pretty rough indeed, which prevents the hurt of a fall; but all this is very tiresome. We met with abundance of holes or nests of black devils, a kind of sea birds, that come from the north, and hatch their young upon this mountain. The birds alone would require a dissertation, which I hope to give hereafter.

Second Journey to The Brimstone-hill.

My curiosity was not satisfied; I wanted to make more accurate observations, and take a more exact view of this mountain. We climbed up a second time with the same and still greater difficulties, because we took the road, that leads to the middle of the mountain. This road is called Tarare, and was to bring us to the pool near the great cleft and the great cavern. I had provided myself with all necessaries for making observations.

We arrived at the little plain, where the pool is. The three times I have seen it, it was little more than 20 or 25 feet square, and contained but little water, which was very ill tasted, and so impregnated with alum as not to be fit to drink. It is situated opposite to the great cleft, about an hundred paces from the great cavern, that is under the cleft. As I intended to lie there, when we got to the place, we pick'd up some wood, kindled a fire, made bundles of fern, and fetch'd water from the head of the river St. Lewis.

We took up our lodging in that great cavern, that answers perpendicularly to the cleft of the mountain.

It

It has no doubt been formed by the same earthquake, that split the mountain in two parts nearly equal. The parting goes North and South; to the North is the cleft and the cavern, in the middle the abyss, and to the South the burning gulph; the whole on a direct line.

This cave appears at first sight very deep, but you get down with ease. At the entrance it may be about twenty 20 or 25 feet wide, as much in height, and about 60 paces deep. At the bottom is a kind of pool, formed by the waters, that drain or ouze from different parts of the vault. The bottom of this pool appears to be an exceeding fine miry earth, like clay mixed with ashes. The water, that distills in these places, is very acid, astringent, sharp, and tastes of alum. The water of the other pool on the outside is much of the same nature, but contains fewer salts; which is a proof, that these two pools are both filled with the waters, that drain from the great cleft. The interior pool may be about 15 feet wide across the cave: They have thrown up a kind of bank, made of rocks, to cross it without sinking into the mud. Before we entered the cave, we lighted some torches made of candle-wood, which I had taken care to provide. The candle-wood is full of resin and very inflammable; the inhabitants cut it in splinters, and tie it up in bundles, which they call torches. When they were well lighted, we crossed the pool, and got upon a small eminence made of stones, that have fallen or separated from the vault: you then go down into a great hole or cave, about sixty feet in length, as much in breadth, and forty in height. Here the heat is moderate

derate. My guide got up upon a second eminence, but told us he was stifled, and could advance no further ; and indeed his torch was going out. This second eminence, or rising, is likewise formed by stones falling from the vault. They are a kind of whitish free stone, covered and incrusted with a very sharp, white, aluminous salt. I then took a torch, and having left a negro at the entrance with another torch to fetch us out, in case of need, we entered the the third cave. Here the heat is excessive, the torch gave no light, and was almost extinguished for want of air, so that we were obliged to wave it about continually. We could hardly fetch breath, and were covered with sweat, and found nothing remarkable but this violent heat. The vault ends here, and we could go no further. We perceived on the left, at coming in, a great hollow place, where we heard the falling of water ; we imagined the vault continued on that side, and stepping down were agreeably surprised to find it cool, and that our torches revived. The space of one fathom made this alteration ; for holding our torches in the right hand extended, they could hardly burn ; whereas in the left stretched out, they burnt very clear This puts me in mind of what happens in the *Grotta de' Cani*, near Pozzuolo in Italy, described by Miffon, vol ii. p. 63. let. 23. too long to be related here.

I went down to the bottom of this hole, where I found nothing but a surprizing cool air. Afterwards we found several holes full of water, less impregnated with salt and a um than that at the entrance. When we came up again, in order to proceed on our way, we were suffocated with the same heat we had felt in coming

coming in. I endeavoured to advance to the right of the cave, but the heat was so violent, that it stopt my breath.

It appeared to me pretty extraordinary, that in one and the same cave, 300 feet under-ground, there should be such a stifling heat on one side, and on the other such an agreeable fresh air. Perhaps the cool side answers to some vent, or communicates with the great cleft by some unknown channel, thro' which the outward air penetrates and cools the place.

In coming out we took care to rest a considerable time in the second cave, to let the violent heat go off, and to dry our shirts, that were soaked through with sweat. We brought away some of the incrustations, and some of the aluminous salt, which I found to be a true alum.

When we came out, I perceived two remarkable things upon my waistcoat; first, that the silver lace was gilt, and looked like tarnished gold lace: but this I was not surprized at, as I knew, that sulphur mixed with salt of tartar will produce that effect: secondly, that the drops of water, which were fallen upon me, were by the heat of the cave turned to alum, and had dried and fastened upon my cloaths. In this cave we found the same sorts of earth as we had met with at the three springs of the river of Galleons, as I mentioned above. They dyed our fingers, and were tasteless, as the former. This is all I observed in the interior cave.

We spent the night in the great cavern. I had brought with me a thermometer and a barometer; but this last was broke by the way, so that I could

make no observations upon the weight of the air ; but with the thermometer I observed, that when we got there, in rainy weather, the glass shewed 15 degrees above temperate, at sun-set 2 degrees ; in the night 5 degrees below temperate ; and at day-break 8 degrees. The thermometer, placed at the entrance of the cave, and sheltered from the wind, shewed 5 degrees of cold ; and expos'd to the wind on the outside, where I felt a very sharp cold, only 2 degrees ; so that there was three degrees difference, which surprized me, as my natural thermometer, I mean my body, convinced me of the contrary. I was very cold without, and felt little or no cold within ; whereas the observations by the thermometer shewed the reverse. I had observed in the plains below, that it shewed about 10 degrees above temperate. By the report, that was made us, the night we spent at the brimstone-hill had been as cold, the wind had blown, the air was very damp, and we had found but 5 degrees of cold ; so that there was 18 degrees difference between the brimstone hill and the plains.

We spent the night very snug upon beds of fern, with a good fire at the mouth of the cave, and were much less troubled with the cold than I expected in so bleak a place.

We came down by the Tarare, which, as I have observed, is a very steep descent. You let yourself down upon a narrow ridge. On each side are precipices, which indeed do not look frightful, because they are covered with trees which conceal them. Half-way down the mountain you find a hot spring, that has nothing particular. At last we got to our horses,

horses, and reached our habitation at the close of night.

Any quantity of brimstone might be fetched from this mountain, even ship-loads. It might be refined upon the spot, or made up into lumps to be sold, and shipped in the ore, if it was necessary; and should this scheme take place, I do not question but the roads might be made easier, so as to load it upon mules at a hundred paces from the gulph: but it is too cheap a commodity to be worth gathering up in a country, where the price of labour is so high from the scarcity of hands. Bright yellow brimstone with a greenish cast might be gathered round the vent-holes of the burning gulph, and likewise large quantities of fine natural flowers, or very pure sulphur. What we call flowers of sulphur is brimstone sublimated, raised and fixed into a very fine and subtle powder. These chymical flowers harden and cake together, and form a solar sulphur as fine as that, which comes from Peru. It is of a bright gold colour. It is found on the sides of the burning funnels or vent-holes; and likewise upon the ground, at the foot of the great cleft northward, is found a kind of brimstone resembling karabe or yellow amber, and altogether as bright and transparent, so as to be mistaken for it. These are particles of sulphur washed and purified by the air, rain, and sun, and I do not think it is possible to see any thing more beautiful of the kind.

I do not doubt but these two sorts of brimstone would be as much valued as what comes from Peru; which being mixt with salt of tartar, produces that liquor, which is made use of to gild metals, and chiefly silver.

In the same funnels you see the spirit of sulphur rise against those sulphureous crystallisations, and drop down like very clear water. The chemists agree, that sulphur is no other than an oily matter fixed by an acid spirit. This is evident from artificial sulphur. By mixing oil of turpentine with spirit of vitriol you obtain a sulphur equal to natural brimstone. It is farther proved by analysing it. An acid spirit may be extracted from it, and its ashes afford but a very small quantity of alkaline salt. What passes in this mountain may be called a natural analysis and distillation. The brimstone takes fire in the center of the earth, as in chemical operations, when the mixture of spirit of nitre and oil of turpentine suddenly produces a surprising heat and flame: in like manner an oily and sulphureous exhalation inflames and sends forth fires, which the ignorant vulgar take for shooting or falling stars.

The flowers rise with the acid spirit, which being condensed by the cool air, falls down in drops. By fixing bell-glasses to the apertures of the funnels, one might collect a spirit, that rises naturally. One of us having thrust his cane too far into one of the funnels, and not being able to pull it out again, helped himself with the blade of his sword to catch hold of it. In an instant we saw the hilt quite wet, and the water dropping off, and when he drew it out, we were surprised to find the blade extremely hot. We could not then save any of this spirit, nor make any experiments upon it. However, I do not believe it is like that, which flows from the baths of Wolckestein in Germany, which Charles Patin says turns to brimstone when

when exposed to the air, and is liquid and clear as water under-ground.

I have gone up this mountain several times to gather simples ; but as the plants it produces, have already been described by the Rev. Fathers Plumier and Feuillée, the two minims, who went for that purpose upon the mountain called Pelée, in the island of Martinico, which is likewise a volcano, and produces the same plants as the Brimstone-hill of Guadelupa ; I shall forbear giving an account of my enquiries in this particular.

LXXXVI. *Account of the Earthquake, felt February 18, along the Coast of England, between Margate and Dover, in a Letter from Mr. Samuel Warren, Supervisor of Excise, to John Windham Bowyer, Esq; one of his Majesty's Commissioners of Excise. Communicated by John Pringle, M. D. F. R. S.*

Honourable Sir,

Read April 1, 1756. Pursuant to an order from Mr. Noble, bearing date the 11th instant, I have made inquiry, as therein directed, relating to a shock of an earthquake, which happened on Wednesday the 18th of February last ; and find, that at Margate it was felt by Mr. Valentine Jewel and his family just before eight o'clock in the morning : they being